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Remarks

Claims 1-5, 7-9, 12-15, 19, and 30-32 remain in the application.

Please note that claims 16, 17, and 19 were amended in the response of March 6, 2006 to have new dependencies although their status was incorrectly labeled as original at that time. The current listing of the claims includes the previously amended dependencies. Claims 6 and 16 have been canceled to simplify the issues on appeal.

Claims 1, 3 and 12-15 have been amended to correct previously unperceived problems with inconsistent use of "substrate" and "wafer". The meaning of the amended claims remains unchanged from those previously examined.

The Examiner has rejected claims 1-9, 12-15, 17-19, and 30-32 under 35 U.S.C. §103(a) as being obvious over Ballance et al. (US Patent 6,090,210, hereafter Ballance) or Anderson et al. (U.S. Patent 6,113,703) in view of Moslehi (U.S. Patent 4,891,499, hereafter Moslehi '499) or Moslehi (U.S. Patent 4,956,538, hereafter Moslehi '538). This rejection is traversed and the examiner is specifically requested to explicitly remove Anderson from all rejections to simplify the issues on appeal.

Claim 1 requires pyrometric monitoring of the bottom, device side of the wafer. Claim 30 depending from claim 3 requires the thermal monitoring to include pyrometry so that the arguments presented for pyrometry apply also to claim 30. Ballance admittedly describes bottom, backside pyrometric monitoring of a conventionally upwardly oriented wafer with front side heating. However, he does not disclose front side pyrometric monitoring as required by this claim. Moslehi '538 is the only reference combining backside heating with pyrometry and he clearly describes and illustrates in FIGS. 2 and 3 one or two pyrometers 26, 28 monitoring the top, back side of the wafer 64. The only bottom front side monitoring is done by the IR detector 59 measuring the radiation transmitted through the wafer 64 by the laser 48, a configuration also described by Moselehi '499.

Contrary to the examiner's statement, Anderson fails to perform backside pyrometry of

the wafer. His backside pyrometer as illustrated in FIG. 1 has a beam extending only to the bottom heat plate 60. As Anderson describes at col. 4, lines 36, 37, the "heat plates 60 and 62 are typically made of a material that is opaque to infrared light." Further, as he states at col. 4, lines 47-49: "Pyrometers 24 and 22 measure the temperature of plates 60 and 62, respectively, and generate signals in response to their measured temperatures." As a result, Anderson is not "pyrometrically monitoring said front side of said wafer" as required by claim 1 but is instead pyrometrically monitoring the outside of an infra-red opaque cavity in which the wafer is disposed. The temperature of the outside of the cavity is only indirectly related to the temperature of the enclosed wafer, particularly since the cavity is being heated from two directions. In the rapid heating characteristic of modern RTP equipment, the temperatures of interior surfaces of the heat plates 60, 62 may well differ from their exterior surfaces, and the temperature of the wafer may well also differ from the temperatures of the interior surfaces of the heat plates. Thus Anderson does not pyrometrically monitor the front side of his substrate, as required by claim 1. Indeed, Anderson's black body cavity seems inconsistent with such direct substrate monitor since the heat plates 60, 62 intermediate his wafer 12 and pyrometers 22, 24 are opaque to infrared light (col. 4, 35, 36).

Yet further, the examiner's characterization of Anderson's sloped annular shelf 16 is incorrect, at least as applied to the claims. It is assumed that the examiner is referring to Anderson's vertically ascending wafer holder 16 and in particular his seats 58 in FIG. 2 rather the flat wafer holder 16 in FIG. 3. Anderson does not describe his seats 58 in great detail but he describes them as discrete and plural and terminating from wafer holder arms 55 (col. 3, ll57-61) Their circumferential extent is insufficient to interfere with gas flow (col. 5, ll. 40-43). Clearly the sloping surfaces of Anderson's seats 58 are not annular but a few, probably three, vertical posts with sloping surfaces on their upper ends.

Further, Anderson makes no mention of the radial positioning of his supporting seats 58 within an edge exclusion zone. Although Anderson does not specify his wafer orientation, it must be assumed that he is orienting his wafers with their device side facing upwardly so that he does not relate his backside wafer support with the edge exclusion zone on the opposite upwardly

facing side.

As for claim 3, Anderson does not thermally monitor the front side of his substrate but only thermally monitors his heat plates.

Anderson's black body cavity seems irrelevant to the reflector recited in base claims 8 and 12

Accordingly, the rejection should be restated as obviousness over Ballance in view of either Moslehi '499 or Moslehi '538. If the examiner persists in his rejection of these claims, he is requested to issue another final office action using only these references so as to simplify the issues on appeal.

Returning to a more detailed rebuttal of the rejection of base claim 1 without further reference to Anderson, Ballance shows a standard RTP configuration of a lamphead 40 irradiating an upper, front side of a wafer 16, a reflector 28 facing the back side of the wafer, and plural pyrometers monitoring the wafer back side.

The two Moslehi references show elements similar to those in the claims but not obviously combinable with Ballance in view of the function described for those elements. The test for obviousness is not whether elements could be substituted from one reference to another but whether it is obvious for the ordinary mechanic reading all the references to perform the substitution required for the combination. Obviousness does not arise merely from a possibility of the combination. Some further reason for making the combination must exist.

Moslehi '499 shows an inverted wafer heated from its backside. However, not only does Moselehi '499 not perform pyrometry, his thermal monitoring is divided into two portions, the top, backside reflectance measurement and a transmission measurement through the bulk of the wafer. Neither measurement is directed to the thermal monitoring of the bottom, front side. Moslehi '538 shows top backside heating of an inverted wafer and two types of thermal monitoring. The thermal monitoring of FIG. 3 is a variant of the backside reflectance and transmission measurement of Moslehi '499. The thermal monitoring of FIGS. 1 and 2 of Moslehi '538 includes pyrometry of the top back side of the wafer. As noted previously, Ballance pyrometrically monitors the back side of the upwardly oriented wafer.

The references must be combined for what they teach. Ballance and Moslehi '538 teach pyrometric monitoring of the wafer back side. Moshehi '499 teaches neither pyrometry nor even clearly thermal monitoring of the wafer front side. Accordingly, if the ordinary mechanic were somehow motivated to invert the wafer of Ballance and heat it from the top, as performed by Ballance and both Moslehi references, he would also be taught by all three references to monitor the wafer back side, as is clearly taught in FIG. 2 of Moslehi '538. That is, Ballance's pyrometry would need to be moved to the top to monitor the wafer back side. Utility is based on the function producing a result not from a reassembly of existing parts in a possible new combination. The functional teachings of the references are stronger then mere physical similarities.

Why would the ordinary mechanic looking at Ballance and the two Moselhi references decide to ignore their teaching of thermal monitoring of the wafer back side. Claim 1 is close to FIG. 2 of Moslehi '538 except for the placement of the pyrometers. Ballance does not render obvious the movement of Moslehi's pyrometers to the bottom.

As for claim 3, none the references teach an annular shelf extending under the substrate around its center on its front side. Dependent claims 31 and 32 require a sloping annular shelf, a feature further not taught by any of the references. Moslehi '499 or '538 also fails to disclose an annular shelf. Moslehi '499 shows an annular heated ring 46 with three pins 50 (FIG. 2) supporting the downwardly facing wafer (col. 6, ll. 57-61). Moslehi '538 is very evasive stating only that the downwardly facing wafer 64 is proximate the window 32 (col. 6, ll 35-38).

Anderson teaches discrete seats on the wafer back side. Ballance teaches an annular shelf under the wafer back side. Moslehi '499 in FIGS. 2 and 3 shows three pins 50 extending under the wafer front side from an annular heater ring 46. Such structure does not conform to the claimed annular shelf. Moslehi '538 is silent on the details of the support. The only clearly taught front side support of an inverted wafer is the three pins of Moslehi '499, which is not the claimed annular shelf. The only obvious combination requiring the inversion of the wafer of either Anderson or Ballance is to replace their back side shelves of Ballance with front side pins. Such pins do not conform to the shelf recited in claim 3. Yet further, Ballance's flat shelves do

not conform to the sloping annular shelves recited in dependent claims 31 and 32.

Yet further, claim 3 requires the shelf to extend no further than the edge exclusion zone. This teaching is totally absent in all the references and is probably contradicted by the relatively large shelves illustrated in Balance. The examiner attempts to justify the edge exclusion zone and the back side holding as avoiding overlapping and not limiting the availability of a working surface. This argument is constructed only in hindsight and is not supported by the references. Faced with the same problem, Moslehi '499 sought to minimize damage with his three small pins, not a narrow annular shelf.

As for claims 8 and 12, only Ballance teaches a reflector and his reflector faces the wafer back side, not the wafer front side required by the claims. Further, claim 9 requires pyrometry of the wafer front side. As discussed above for claim 1, the combination of all the applied art fails to render this feature obvious. Yet further, claims 13 and 14 impose the limitation of the support to the edge exclusion zone. Such is not evident in the applied references. Also, claim 15 requires backside holding means for the inverted wafer. The applied art omits such elements. Moslehi '499 teaches front side support but does not seem to care how far in it extends.

The Examiner has rejected claim 16 under 35 U.S.C. §103(a) as being obvious over Ballan ce or Anderson in view of Moslehi '499 or Moslehi '538 and further in view of McNeilly et al. (U.S. Patent 4,047,496, hereafter McNeillly) or Samoilov et al. (U.S. Patent 6,455,814, hereafter Samoilov). This claim has been canceled.

Entry of the amendments is respectfully requested under 37 CFR 1.116 as correcting previously undetected formal problems, canceling a claim, and putting the application in better condition for appeal.

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In view of the above amendments and remarks, reconsideration and allowance of all claims are respectfully requested. If the Examiner believes that a telephone interview would be helpful, he is invited to contact the undersigned attorney at the listed telephone number, which is on California time.

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Respectfully submitted,

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